notes which accompany each figure are interesting, but unfortunately sometimes "popularize" facts at the expense of accuracy. It needs to be insisted upon that simplicity of statement need not involve any inaccuracy. Why, for example, should the author mislead his readers by comparing the chicory head with a single flower in this wise: "Not only these straps, but the center of the flower (the stamens and styles) looks very much like the dandelion." And of the everlasting (*Gnaphalium*) he writes: " . . . the little white flowers are so much like miniature pond lilies under the microscope that the resemblance is amusing," For the readers, however, these slips will not be disquieting, and are only worth mention because they mar an otherwise good book.—C. R. B.

ONE OF THE most interesting contributions from the National Herbarium is that by Mr. P. A. Rydberg upon the flora of the Black Hills of South Dakota.[6] The region is often called an intermediate one, because the floras both east and west of it have received more attention. The report, therefore, deals with one of the regions most in need of investigation. In his prefatory discussion Mr. Rydberg deals with such topics as geography, geology, altitudes, precipitation and temperature, and floral districts. Under the last topic he considers five districts differing in topographical and climatic conditions, and hence in vegetation. They are the foothills, Minnekahta plains, Harney mountain range, limestone district, and northern hills. It is interesting to note that the characteristic plants of the foothill region are grouped as follows: very hairy plants; plants with a glaucous foliage having a hard epidermis; plants with white, often shreddy, stems; plants in which the surface is reduced to a minimum; and plants with a deep-seated, enlarged root. The catalogue of species, which is full of valuable notes as to range and habit, contains about 700 spermatophytes and pteridophytes. One of the most interesting discoveries was that of true *Aquilegia brevistyla* in the United States, the plant from the Rocky mountains heretofore bearing that name having been proved to be quite a distinct species, which Mr. Rydberg has called *A. saximontana*. The plates consist of a good map of the region the two Aquilegias referred to, and *Poa pseudopratensis*, a new grass.—J. M. C.

NOTES FOR STUDENTS.

ROSENBERG has found[7] that in herbaceous perennials differences in the starch content exist in the course of the winter similar to those well known in trees through the very exhaustive researches of Fischer.—C. R. B.

[6] RYDBERG, P. A.—Flora of the Black Hills of South Dakota. Contributions from the U. S. National Herbarium **3**: 463–536. 1896. [No. 8.]

[7] Bot. Centralb. **66**: 337. 1896.

DANGEARD has described the life-history of a parasite of the nucleus of *Amœba*, and named it *Nucleophaga Amœbæ*. It is probably one of the lowest Chytridiaceæ, related to *Sphærita*, which is a recently discovered parasite on *Euglena*.[8]—C. R. B.

IN REVIEWING the species of *Asimina*, Mr. Geo. F. Nash recognizes (*Bull. Torr. Bot. Club* 23:234. 1896) seven species, one of which (*A. speciosa*) is described for the first time, having been confused heretofore with *A. grandiflora* Dunal, which becomes *A. obovata* (Willd.)—J. M. C.

DR. F. W. KLATT has just described (*Bull. Herb. Boiss.* 4:456–475 and 479, 480. 1896) the following new genera of Compositæ, all African except the last, which is Cuban: *Symphipappus* (Inuloideæ), *Distegia* (Helianthoideæ), *Dolosanthus* (Mutisiaceæ), *Monactinocephalus* (Mutisiaceæ), and *Lepidesmia* (Eupatoriaceæ?). Each genus is illustrated with a plate.—J. M. C.

WINOGRADSKY has communicated to the Paris Academy of Sciences[9] the results of M. V. Fribes' researches in his laboratory at St. Petersburgh upon the maceration of flax for the isolation of the fibers. The rotting is due to an obligate anaerobic bacillus, which acts not as a cellulose ferment but as a pectin ferment. It dissolves the middle lamella of the cortical parenchyma which consists of calcium pectinate, and thus isolates the fibers.—C. R. B.

MR. P. A. RYDBERG has begun a series of notes on *Potentilla* (*Bull. Torr. Bot. Club* 23:244. 1896), in which his views as to the limitation of species differ widely from those of Dr. Watson (*Proc. Amer. Acad.* 8:549–573), and agree closely with those of Dr. Christian Lehmann, of Hamburg, whose "Revisio Potentillarum" (1856) serves as a basis for the present work. As the genus is one of the most perplexing of our flora it is to be hoped that Mr. Rydberg will be successful in this attempt to disentangle the species.—J. M. C.

M. J. BRIQUET announces (*Bull. Herb. Boiss.* 4:354. 1896) the discovery of a hybrid between *Bupleurum ranunculoides* and *B. longifolium*, two species very distinct morphologically and topographically. The discovery is interesting, not merely on account of the distinctness of the parent species, but also because of the extreme rarity of reported hybrids among the Umbelliferæ. The hybrid, named *B. Guineti*, seems well established, is distinctly intermediate in its characters, and exhibits a wide range of variation.—J. M. C.

AMONG THE NEW Verbenaceæ recently described by J. Briquet (*Bull. Herb. Boiss.* 4:336. 1896), *Xeroplana* is a new genus from South Africa; *Lippia Pringlei* is a new species from Guadalajura, Mexico (*Pringle* 1733, dis-

[8] *Cf.* Bot. Centralb. 66: 256. 1896.

[9] Compt. Rend. 121: 742. 18 N 1895.

trib. of 1888); *Callicarpa Pringlei* is a new species from San Luis Potosi (*Pringle* 3094); *Vitex Hemsleyi* is a new species from near Oaxaca (*Jurgensen* 68), referred to by Hemsley in Biol. Centr.-Am. Bot. **2**: 540; *Citharexylum Jurgenseni* is a new species from near Oaxaca (*Jurgensen* 259); and the remaining nine species are mostly from northwestern South America.—J. M. C.

ABOUT A YEAR and a half ago Askenasy suggested that the vexed question of the ascent of water in plants was explicable by the force of imbibition of the cell-walls of the leaves and the cohesion of the water columns in the ducts.[10] He has devised an ingenious apparatus to illustrate the physical principles involved, which imitates fairly well the conditions in the plant. The fault common to the apparatus used by Jamin, Naegeli, and Strasburger is that the conducting portion consisted of porous material and was not essentially different from the evaporating and lifting portion. Askenasy's apparatus consists of a glass tube 90^{cm} long and 2.2–3.5^{cm} in diameter, ending in a small funnel which is plugged with gypsum or even has the gypsum spread over its whole inner surface. The gypsum corresponds to the membranes of the leaf, the tube to the wood vessels in which the water ascends. With certain precautions the tube is filled with water, its open end immersed in mercury, and fastened upright. In one experiment in 33 hours the mercury rose to 82^{cm}, and in another in 26 hours to 89^{cm}, *i. e.*, into contact with the gypsum. In the first its complete ascent was hindered by the formation of an air bubble. (*Cf.* Bot. Centralb. **66**: 379. 1896)—C. R. B.

DR. MAXWELL T. MASTERS has published from time to time the results of his researches among the Coniferæ. His most recent contribution deals with the genus *Cupressus*,[11] which he has reexamined with fuller material and assistance. The genus he regards as well-defined among its allies by the peltate expansion at the free end of the cone-scales, but the species are very difficult of limitation on account of the great inconstancy of the characters used, as well as the long cultivation of many of them. They are remarkably polymorphic, a certain well-known "stage of growth" in some species having given rise to the old genus *Retinospora*. The author regards *Chamæcyparis* as unworthy of generic rank, and is inclined to believe that the closely allied *Thuya* and *Libocedrus* might well be merged under *Cupressus*. His presentation of the alliances represents two divergent lines from *Cupressus*; one leading to *Juniperus*; the other, through the *Chamæcyparis* forms, leading to *Thuya*, *Libocedrus*, and *Fitzroya*. The varieties of foliage are discussed, but no physiological or phylogenetic significance suggested as explanatory of their

[10] Verh. nat. hist.-med. Ver. zu Heidelberg N. S. **5**: (1–23). 1895. *Cf.* Bot. Cent. **60**: 237. 1895.

[11] MASTERS, MAXWELL T.—A general view of the genus Cupressus. Jour. Linn. Soc. Bot. **31**: 312–363. 1895.

extreme anatomical diversity. The cone-scale, that fruitful organ for morphological discussion, shows distinctly its double nature in containing two distinct vascular systems, which are given off separately from the axis, the system of the seminiferous-scale portion having an inverse orientation of its elements. Fourteen species are recognized, five of which belong to the subgenus *Chamæcyparis*. The North American species are as follows: *C. Benthami*, of Central America, Mexico, and adjacent United States, and under which Greene's *C. Arizonica* appears as a variety; *C. macrocarpa*, of California, under which Watson's *C. Guadalupensis* appears as a variety; *C. Goveniana*, of California; *C. Macnabiana*, of California; *C. thurifera*, of Mexico; *C. thyoides* (*Chamæcyparis sphæroidea*, *Thuya sphæroidea*), of the Atlantic coast; *C. Nootkatensis* (*Cham. Nutkænsis*, *Thuya excelsa*), of the Pacific region from Oregon to Alaska; and *C. Lawsoniana* (*Cham. Lawsoniana*), of California and Oregon.—J. M. C.

MR. F. W. KEEBLE, during a brief stay in Ceylon in 1894, made a very considerable number of interesting observations, some of which he presents in a paper published in the Transactions of the Linnean Society of London, and more of which he promises to give in subsequent papers. In the present paper he sets down some of his observations on the Loranthaceæ native in Ceylon.[12] These green, semi-parasitic phanerogams have been attracting more than usual attention of late, as is shown by Van Tieghem's numerous publications concerning them, as well as others by less well known authors. Mr. Keeble's paper concerns itself first with the pollination of the flowers, which are large and conspicuous in many species, and deviate more or less from the regular type. To the observations of Wallace and others, that the tubular loranths are bird-pollinated, Keeble adds his own, giving greater precision to what was already known and contributing some new facts. Those flowers which depart from the type by developing a slit in the tubular corolla, and by placing the opened anthers in a row behind the style instead of in a ring around it, apparently derive a double advantage. The birds which frequent these flowers, being larger and less accurate in their movements than pollinating insects, are likely to rupture the delicate parts more or less, and do this even when the corolla is already split and the stamens are arranged in a row, though of course to a smaller and less damaging extent in such cases. Furthermore, their beaks, when these come into contact with the anthers on pushing into the flower, become dusted with pollen only upon the upper half, and deposit some of their pollen upon the protruding style of the next flower visited before pushing against its anthers. In those species whose otherwise tubular corolla is cleft, the stealing of nectar by birds which bite into the corolla-tube without cross-pollinating is materially less than in other species. A very considerable number of species have flowers which open only when

[12] Transactions Linnean Society of London, 2d Series, Botany **5**: [May]. 1896.

struck. The blows which are needed to open such mature flowers are ordinarily given by the birds which frequent them. Mr. Keeble suggests that this is an adaptation which is mutually advantageous: "The bird knows it is worth its while to 'tap a new barrel' as it were," for obviously there will be most nectar in such still unopened, and ence unvisited, flowers; and the pollen is protected from rain. This, since the majority of the species with exploding flowers either blossom during the rainy season or else grow where there is almost daily rain the year through, is a matter of considerable importance. Blossoming during the rains, even when not a matter of necessity, may be an advantage, since the seeds germinate most successfully, if not exclusively, in moist air.

As to the dissemination of seeds, Mr. Keeble disagrees somewhat with the generalizations of some authors on the subject,[13] to the effect that the seeds pass through the alimentary canal of birds and are dropped in their excrement unharmed upon the branches of trees. He finds that, of the large seeds at least, such few as are swallowed are decomposed, if not profitably digested, but that most of them are carefully expelled from the fleshy pulp before it is eaten, and if they adhere to the bird's beak are rubbed off upon any convenient object, a branch or even a telegraph wire. "On the single telegraph wire," at the Hill-Garden of Hakgala, "there are every year hundreds of seedlings of *Loranthus loniceroides*, all in early stages of germination." Furthermore, the large amount of tannin found in the coats of the seeds would make them unpalatable, and prove a useful protection against the seeds being swallowed.

In the tropical species of the Loranthaceæ, germination begins as soon as the ripe seeds have fallen where there is sufficient moisture, if not in the substratum, at least in the air. In *Loranthus loniceroides* the large seed sticks in a vertical position upon a branch or similar object, usually with the plumule pointing downwards because of the very adhesive *viscin* which is most abundant at this end. From the upper end the chlorophyll containing hypocotyl grows out, its enlarged apex or head pointing vertically upwards and carrying a drop of resin. During its subsequent growth, the hypocotyl curves over and finally, if it has attained sufficient length so to do, applies its head, now enlarged somewhat into a disc-shaped "sucker," vertically upon the support. The cells in the center of the sucker become papillate and penetrate the superficial cells of the host, while meantime the peripheral cells of the sucker have multiplied and grown, and thus furnish a broader and stronger attachment to the host. After such an attachment has been effected, the hypocotyl straightens, thus detaching the seed from the branch and carrying it up into the air. Much of the food has been transferred from the endosperm to the hypocotyl and may perhaps be temporarily stored, for the nourishment of

[13] "The Natural History of Plants," Kerner, trans. Oliver, 2: 205.

the haustorium, in the enlarged sucker. Then the cotyledons and the remainder of the endosperm are cast off and the plumule appears. This small structure develops minute leaves in pairs upon successive nodes separated by very short internodes, the leaves falling soon after formation. Only after the haustorium has penetrated the host does any development of branches take place; then, however, growth becomes very rapid and large leaves form. Mr. Keeble interprets the growth of a lateral aerial root from the sucker, a phenomenon which not infrequently occurs before the penetration of the haustorium into the host, especially on small or poorly nourished branches, as throwing light on the manner in which these plants became parasitic. "The seeds, originally sticky, often lodged on trees, and, as in many species of Ficus, these seeds, germinating, threw out roots which rapidly reached the ground, or the earth which collects in the forks of trees. To enable the plant to exist in this early non-parasitic stage, the base (free end) of the sucker came to function as a reserve food store. From this stage the natural semi-parasitism was reached by the ability of certain cells of the distal end of the hypocotyl to penetrate the host."

The curvature of the hypocotyl, above referred to, has long been known to be independent of gravitation (it is ageotropic) and has been attributed solely to the influence of light (it is negatively heliotropic, and hence bends toward the central shaded portion of the tree to reach the branch upon which the seed has fallen and stuck); but Keeble demonstrates, by germinating the seeds in the dark, that the hypocotyls of some species imitate tendrils, and hence may, often do, succeed in applying their enlarged heads to the surface of branches in this way. Owing to the resinous matter which covers them, the heads stick. In these species, the nutation may cause the head or sucker end of the hypocotyl to point temporarily directly towards the light, but it obviously supplements the negatively heliotropic curvature at other times and hence is advantageous to the seedling. Though the general surface of the hypocotyl is not sensitive to the contact of solid bodies, the growth of the head or sucker, and its close application and subsequent attachment to the branch, are to be attributed in part to irritation by such contact. Contact with lifeless or otherwise innutritious objects does not, however, induce such active and prolonged growth as is produced by contact with a suitable host. On the other hand, the growth of the haustorium from the head and toward the solid object seems to be induced by contact with any solid body. Keeble describes an experiment in which he applied a small cover-glass to the head of the hypocotyl of *L. loniceroides*, with the result that there was only slight enlargement of the head, which had not developed an effective sucker, though it remained fast by reason of the adhesive resin, whereas the haustorium had grown out to a distance of 2^{mm} beyond the margin of the disc, being deflected from its course by impenetrable glass. The cells which form the central part of the surface

of a sucker which is in contact with a host become papillate, and, by pressure and solvent action combined, penetrate the superficial cells of the host. When these have succeeded in penetrating, the sucker enlarges still more, and thus furnishes a strong brace for the haustorium, which must necessarily develop considerable pressure to penetrate into the deeper tissues of the host, although at the same time it may perhaps supplement this mechanical penetration by the softening or solvent action of any enzymes which it may be able to secrete. In these ways the behavior of the haustorium and the sucking-disc of the Loranthaceæ is not unlike that of the completely parasitic phanerogams. In an appendix, Mr. Keeble describes the forms of the fruits and seeds of some of the Cingalese Loranthaceæ. This interesting and suggestive paper is illustrated by several woodcuts and two large well-executed lithographic plates.—GEORGE J. PEIRCE.